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CRITERIA FOR THE ESTABLISHMENT AND MAINTENANCE OF TWO YEAR POST HIGH SCHOOL WASTEWATER TECHNOLOGY TRAINING PROGRAMS

VOLUME I. PROGRAM CRITERIA

CLEMSON UNIVERSITY, SOUTH CAROLINA.
DEPARTMENT OF ENVIRONMENTAL SYSTEMS ENGINEERING

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
TRAINING GRANTS BRANCH

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VOLUME I

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ENVIRONMENTAL PROTECTION AGENCY
CLEMSON UNIVERSITY

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CLEMSON UNIVERSITY

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Robert L. Reynolds
Principal Consultant

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The challenge of wastewater treatment in the seventies must be met with an adequate supply of competent, skilled plant operators and technicians. Many farsighted people have an interest in and a concern for meeting this challenge, and the *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* is the result of their efforts.

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VOLUME II: CURRICULUM GUIDELINES

PREFACE

The need for a document such as *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* was implied in the Water Quality Improvement Act of 1970 (Public Law 91-224, 91st Congress, H.R. 4148) which stated in part:

> " . . . the Secretary is authorized to make grants to or contracts with institutions of higher education, or combinations of such institutions, to assist them in planning, developing, strengthening, improving, or carrying out programs or projects for the preparation of undergraduate students to enter an occupation which involves the design, operation, and maintenance of treatment works, and other facilities whose purpose is water quality control. Such grants or contracts may include payment of all or part of the cost of programs or projects such as--
>
> "(A) planning for the development or expansion of programs or projects for training persons in the operation and maintenance of treatment works;
>
> "(B) training and retraining of faculty members;
>
> "(C) conduct of short-term or regular session institutes for study by persons engaged in, or preparing to engage in, the preparation of students preparing to enter an occupation involving the operation and maintenance of treatment works;
>
> "(D) carrying out innovative and experimental programs of cooperative education involving alternate periods of full-time or part-time employment involving the operation and maintenance of treatment works; and
>
> "(E) research into, and development of, methods of training students and faculty, including the preparation of teaching materials and the planning of a curriculum."

The goal of the *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* was the preparation of criteria for the development of useful and practical training programs to meet urgent manpower requirements in wastewater treatment plants. This goal has been achieved with the invaluable assistance of experienced wastewater treatment plant personnel.

INTRODUCTION

The *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* is contained in two volumes. Each volume is essentially self-contained and, if circumstances warrant, each may be used independent of the other.

Volume I: Program Criteria provides an overall statement of the criteria for the selection of institutions as training facilities. These criteria are in a form appropriate for soliciting a self-appraisal by interested institutions. Supporting the basic self-appraisal criteria in *Volume I* are statements on the trainee characteristics before and after training, the form and function of the management structure for the overall program, and a glossary of important terminology.

Volume II: Curriculum Guidelines provides rather detailed information relating to the posttraining performance (skill and knowledge) desired of trainees. Institutions seeking to have their programs funded must provide a curriculum based on the guidelines in *Volume II*.

Users of the *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* are encouraged to perform a cursory examination of the two volumes for form and type of content before settling down to the intensive use of a specific section.

CRITERIA FOR PREPARATION OF SELF APPRAISAL BY INSTITUTIONS SEEKING TWO YEAR POST HIGH SCHOOL WASTEWATER TECHNOLOGY TRAINING PROGRAM AWARD

The document entitled *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs (CEWT)* provides essential information on how to establish and maintain a Two Year Post High School Wastewater Technology Training Program (WWTP). The present section of the *CEWT* document indicates to training institutions applying for WWTP funding, the form, content, and criteria to which an institution must address itself in its self appraisal.* The self appraisal must indicate unequivocally the institution's acceptance of and ability to establish and maintain a WWTP in accordance with the intent of the funding agency as indicated by the *CEWT* and its managerial representatives.** The criteria in this section also will be used with other information to evaluate the conduct and effectiveness of the WWTP of selected training institutions.

An institution wishing to qualify for WWTP funding will demonstrate how it now conforms, or will conform, to the criteria stated herein. An institution will indicate this in its self appraisal in one or more of the following ways as appropriate:

1. Concurring statements
2. Descriptions of existing conformance
3. Descriptions of proposed conformance.

The actual documentation of an institution's self appraisal will be organized and referenced to conform with that of the following criteria:***

---

* As needed, for an illustration of the concept of self appraisal applied, refer to your regional accrediting agency for a descriptive information booklet.

** The Institutional Advisory Board, Review Committee, and Central Coordinating Committee as presented more fully on page 9.

*** All criteria stated herein are subject to modification and interpretation by the funding agency and its prime representative, the Central Coordinating Committee.

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A. PHILOSOPHY AND PURPOSE OF INSTITUTION

1. The institution will certify that it has thoroughly informed itself of the intent and purpose of the funding agency through reference to the *CEWT*, and in particular the *Curriculum Guidelines (Volume II)*, and that its own philosophy and purpose will be in accord therewith. The institutional philosophy must be conducive to the effective achievement of the *CEWT* objectives.

2. The institution will:
   a. Be a public or private, nonprofit institution
   b. Have a clear emphasis on occupational training as one of its purposes
   c. Offer post-secondary instruction leading to an Associate's degree
   d. Allow entrance of non-high school graduates into its occupational training programs
   e. Offer remedial instruction in basic education.

B. ADMININSTRATIVE SUPPORT AND GENERAL INSTITUTIONAL REQUIREMENTS

1. An institution selected as a training facility must exhibit an interest in the training program and concern for its efficient and effective implementation at the administrative as well as instructional levels. This bilateral support of the program must be clearly demonstrated.

2. There must be institutional support of the WWTP instructional program. Institutional funds must be budgeted for the professional development of the instructional staff to include contact with other professionals in the field at the local, state, and national levels. There must be budgeted allocations for instructor travel and participation in professional meetings on a scheduled basis. A reasonable minimum of such activities will include the following:
   a. National meeting--annually
   b. Professional seminars--biannually
   c. Continuing education course--annually

d. Professional society (local)--at the discretion of the instructor

e. Seminar or short course study of advances in instructional technology (including innovative teaching techniques) with emphasis in the area of the development and use of individualized instructional materials--annually.

3. The instructors' professional development activities will be reported in writing to the Central Coordinating Committee at the end of each year.

4. The institution must provide adequate ancillary personnel to efficiently and effectively conduct noninstructional activities in support of the instructional program.

5. The institution must not have a percentage limitation on out-of-state students.

6. The institution must maintain an active student personnel services department which has as its main purpose the successful articulation of the needs, desires, abilities of potential and currently enrolled students. Student personnel services are to include the following:
   a. Student counseling services
   b. Student record system
   c. Maintaining and fostering programs of student activities
   d. Health services
   e. Financial assistance
   f. Student housing assistance
   g. Student testing and evaluation.

C. CURRICULUM

1. The WWTP curriculum will be developed in accordance with the *CEWT Curriculum Guidelines (Volume II)*. The responsibility for the development of the curriculum may not be placed upon the present instructional staff members as an addition to their current work load. The administration of the institution will indicate its intentions with respect to work load reductions for

presently employed personnel and/or the employment of qualified personnel not presently employed. Those who undertake the project must be allowed sufficient operational latitude to accomplish the objectives of the program.

2. Institutions which are designated as training facilities will work directly with the Central Coordinating Committee as required to develop a core curriculum within the framework of the *Curriculum Guidelines*. The Committee, in consultation with the instructors at the training facilities, will work to adapt the core curriculum so that it best serves the needs of each institution involved in the project.

D. INSTRUCTIONAL METHODS AND MEDIA

1. Proper representation of wastewater treatment plant equipment and supplies must be available to support the practical, hands-on intent of the training program. The equipment must represent that currently used in the industry and be consistent with the *Curriculum Guidelines*.

2. Course content will be developed and specified by the Central Coordinating Committee with the assistance of the instructors from the training facilities. Strict adherence to the *Curriculum Guidelines* will be required.

3. The institution must have a cooperative arrangement with local industry or municipal wastewater treatment plants which permits in-plant instruction involving real equipment, real processes, and real situations. The Institutional Advisory Board will play a major role in implementing the work experience aspect of the program.

4. Institutions selected as training facilities must make effective use of such materials as individualized instruction, especially in remedial instruction in basic education. Individualized instruction, as used herein, is represented by at least one, preferably both, of the following characteristics: (1) selective

assignment of instruction to the trainee according to individual need is facilitated by pre- and posttesting, and (2) the trainee is permitted to learn at his own pace. Where necessary, instruction may be presented to a group, but the first characteristic must not be violated. All instruction should maximize the active involvement of the trainee by having him frequently answer questions, solve problems, and react to the information he is currently learning. The trainee must be provided prompt feedback regarding the correctness of his responses. Instruction should be modularized to facilitate individualizing a trainee's learning experiences, and all increments of instruction should be sized and sequenced to ensure the trainee's smooth and confident transition from the known to the unknown. Individualized instruction includes, but is not restricted to, instruction often referred to as "programmed".

E. INSTRUCTIONAL STAFF

1. Technical qualifications include the B. S. degree and two years' full-time work experience or six years' full-time work experience in the field involving contact with the systems and processes to be taught. These requirements may be met, at the discretion of the institution, through the employment of qualified people or the correction of deficiencies, if any, among the present technical staff.

2. Teaching responsibilities must be such that students may receive individual assistance and guidance from the instructor. Total teaching contact hours, lecture and laboratory combined, will not exceed 20 hours per week. The balance of the instructor's time will be spent in the following activities related to the WWTP:
   a. Providing a maximum of individual assistance and guidance to trainees
   b. Program development with the Central Coordinating Committee
   c. Professional development
   d. Arranging and coordinating in-plant instruction schedules and facilities

e. Recruitment and placement of trainees.

F. PHYSICAL FACILITIES

1. There must be physical facilities to provide instruction in accordance with the requirements of the *Curriculum Guidelines*.

2. Adequate storage and noninstructional space must be available to accommodate the number of students and staff expected to use the area.

3. Adequate plans for expansion of the facilities, if required, must be indicated.

G. RECRUITMENT OF TRAINEES AND PLACEMENT OF GRADUATES*

1. The institution is to have a plan for recruiting students for the program. The recruitment program should embrace the entire geographic region and include activities that will communicate with the secondary school authorities, the general public, and the public and private organizations connected with the wastewater treatment field.

2. Recruiting brochures, pamphlets, and announcements must be factual and accurately stated, presented in a manner that will bring dignity to the program.

3. Potential trainees will be given an orientation tour of a wastewater treatment plant prior to final enrollment.

4. Admissions policies must be realistic in that a student who is admitted should have a reasonable expectation of success.

5. Admissions policies will allow entrance of non-high school graduates who demonstrate the desire and the capability to succeed in the program.

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* For a more complete development of the trainee entry and posttraining characteristics, see page 21.

6. Admissions policies will allow the admission of currently employed wastewater treatment plant employees. Reasonable exemptions for experience must be established.

7. The institution, specifically the program director, will assume the primary responsibility for the placement of graduates. Every reasonable effort will be made to place graduates in work situations which utilize their training in the wastewater treatment field.

H. PUBLIC RELATIONS

The school must show an awareness of the benefit of a public relations program as it relates to the WWTP.

I. INSTITUTIONAL ADVISORY BOARD

The institution must utilize the services of its Advisory Board and cooperate with the Regional Director of the WQO in its establishment (see pages 11 and 12).

J. REVIEW COMMITTEE

The institution must cooperate with the Review Committee providing such information and services as may be required of them pursuant to the responsibilities of the Review Committee (see page 14).

K. CENTRAL COORDINATING COMMITTEE

The institution must cooperate with the Central Coordinating Committee providing such information and services as may be required of them pursuant to the responsibilities of the Central Coordinating Committee (see page 17).

L. APPLICATION AND IMPLEMENTATION PROCEDURES

1. The institution desiring to become a training facility will make application to the funding agency.

2. The funding agency will assist the institution in reviewing the criteria and the procedure for preparation of the self-evaluation in response to the *CEWT*.

3. The institution will conduct a self-evaluation in relation to the *CEWT* and prepare a written report that responds specifically to each criteria. This response is to reflect how the institution meets the various criteria.

4. The funding agency will review the institution's self-evaluation document and assign an evaluation team to make an on-site inspection. The on-site team will make its recommendations to the funding agency as to the adequacy of the institution's self-evaluation. The funding agency will select the institutions which most adequately meet the *CEWT*.

5. After the training program is implemented at the selected institutions, the funding agency will designate on-site inspection teams for the evaluation of the training program at scheduled intervals.

MANAGEMENT COMPONENTS
TWO YEAR POST HIGH SCHOOL WASTEWATER TECHNOLOGY TRAINING PROGRAM

The purpose of this section is to define the responsibility, organization, and operation of the recommended management components for the Two Year Post High School Wastewater Technology Training Program. These management components include the Central Coordinating Committee, the Review Committee, and the Institutional Advisory Board.

PURPOSE

The purposes of the management components recommended are the following:

1. Advise the funding agency on the eligibility of proposals
2. Provide the management framework within which proposals will be reviewed and implemented and the ongoing and completed projects monitored and evaluated
3. Assure a comprehensive, objective review for maximum efficiency and effectiveness of training programs and utilization of training resources
4. Preclude support of inappropriate training activities, unnecessary duplication or fragmentation
5. Consult with qualified representatives of interested professions and agencies aware of regional and local manpower needs and issues
6. Achieve coordination and cooperation of training efforts within the same and with other sponsoring agencies
7. Fulfill the need to acquire high quality training programs relevant to skills needed for the national pollution control mission.

INSTITUTIONAL ADVISORY BOARD

A. Responsibilities

The responsibilities of the Instititutional Advisory Board will include the following:

1. Assist with the recruitment of trainees for the training program
2. Assist with the selection of in-plant instruction sites for use by the institution
3. Assist with the placement of trainees for in-plant instruction during their training program
4. Assist with the placement of trainees upon completion of their training program
5. Assist with the upgrading of entrance job classification and pay scale for the program graduate
6. Assist with the acceptance of the graduate by civil service systems, unions, and other employing and certifying organizations
7. Assist with the improvement of equipment and facilities at the training institution.

B. Organization

1. The Institutional Advisory Board will be appointed, in consultation with the officials of the funded institution, by the Regional Director of the WQO in the region in which the institution is located.
2. The Chairman of the Institutional Advisory Board will be a representative of the Regional WQO.
3. The other members of the Institutional Advisory Board will be comprised of no fewer than seven (7) persons sufficiently representative of those regional and local organizations and professional groups having concern for the quality of wastewater treatment operations and related training. The members may represent, but not necessarily be limited to, the following:
   a. State official agencies governing the registration and qualifications of wastewater treatment employees
   b. State officials of water pollution control authority
   c. State civil service or merit systems
   d. Unions
   e. Personnel advancement or education committees of water pollution control associations

f. Water and wastewater equipment manufacturers' association

g. Practicing wastewater treatment plant operators

h. Municipal league

i. Professional sanitary engineers (consultation and design)

j. Local manager of cooperating wastewater treatment plant

k. Professional education and training

l. Two year post high school wastewater technology training institutions

m. Manufacturing industry having wastewater treatment facilities

n. Others, as deemed advisable by the above committee representatives and at the discretion of the Regional WQO.

4. Members will be appointed by the Regional Director of WQO for a period of two years and in such manner that not more than one-half of the members will be replaced in any single year.

5. Each member will have voting privileges, with the exception of the Chairman.

6. No member will be precluded from service with similar committees of other sponsoring agencies.

7. The work of the committee will be financed by the funded institution, providing reimbursement of expenses and an hourly fee set by the funding agency, upon written request of each member.

C. Operation

1. Meetings will be called by the Chairman, not less than once each half year, at a time and place to be determined by the Chairman.

2. The presence of at least half of the voting members, but not less than five (5), will constitute a quorum sufficient for the conduct of business.

3. All motions will be carried by simple majority vote.

4. The Chairman will see to it that the responsibilities mentioned above are carried out so as to benefit the training program to the maximum extent.

REVIEW COMMITTEE

A. Responsibilities

The responsibilities of the Review Committee will include the following:

1. Receive, by referral from the funding agency, applications for grants for training institutions
2. Review proposals according to criteria, guidelines, and other information provided by the funding agency and the Central Coordinating Committee
3. Gather information and perform inspections and interviews necessary for a comprehensive review of the proposal and as required or requested by the funding agency
4. Recommend to the funding agency the following:
   a. Whether the criteria are fulfilled and the proposal is eligible for funding
   b. Whether the applicant may resubmit the proposal with recommended revisions and without prejudice to reconsideration
5. Periodically evaluate the progress of funded projects and report to the funding agency with regard to the following:
   a. Compliance with criteria
   b. Compliance with the approved proposal
   c. Required changes or improvements
   d. Continuation of funding
   e. Termination of funding
6. Receive proposals for modifications and amendments to funded projects and make appropriate recommendations to the funding agency
7. Periodically review criteria and guidelines adopted by the funding agency and recommend modifications
8. Utilize the full services of the Central Coordinating Committee and avoid duplication of their responsibilities.

B. Organization

1. The Review Committee will be appointed by the funding agency.

2. The Chairman of the Review Committee will be an employee of the funding agency and will act for and on behalf of the funding agency.

3. The other members of the Review Committee will be comprised of no fewer than seven (7) persons representative of at least the following:

   a. Technical schools with existing quality training programs in wastewater treatment

   b. Professional sanitary engineers currently engaged in plant operation

   c. Wastewater treatment operators currently engaged in plant operation

   d. Management representatives from related professional associations

   e. Instructional technology

   f. The Central Coordinating Committee.

4. Each member will be appointed by the funding agency for the period of time designated by the conduct of the proposed project. Replacements may be requested and filled by the funding agency.

5. Each member will have voting privileges, with the exception of the Chairman.

6. No member will be precluded from service with a similar committee of other funding agencies.

7. Any member having an official relationship to an applicant will make his position known and will absent himself from committee deliberations and voting in relation to that applicant.

8. The work of the committee will be financed by the funding agency, providing reimbursement of expenses and a fee set by the agency, upon written request of each member.

C. Operation

1. Meetings will be called by the Chairman at a time and place of his choosing.

2. The presence of at least half of the voting members, but not less than five, will constitute a quorum for the conduct of business.

3. All motions will be carried by simple majority vote.

4. Upon review of proposals, the committee will recommend to the funding agency that each proposal is as follows:
   a. Eligible for funding, with a value rating assigned according to item 5 following
   b. Ineligible for funding
   c. Worthy of reconsideration upon modification and without prejudice by prior review.

5. Recommendations with regard to eligible proposals will be on the basis of committee vote according to a weighted scale and according to the following procedure:
   a. Each voting member will assign a value to the proposal on a scale of 1 through 5, according to the merits of the proposal, with the number 1 reflecting the highest merit.
   b. The total of values assigned by all members will be assigned to the project and will represent a place in the order of merit for which the several projects will be recommended to the funding agency.

6. All votes will be recorded and incorporated in the permanent record of the project and held by the funding agency. Rejection of any proposal will be supported by a written report of the committee and incorporated in the permanent record of the project and held by the funding agency.

7. The vote and report of the committee will constitute its recommendations to the funding agency.

8. The Chairman will maintain a correct record of the proceedings and determinations of the committee.

9. The committee may engage staff support or consultants upon request to and approval by the funding agency, according to limitations set by said agency.

CENTRAL COORDINATING COMMITTEE

A. Responsibilities

The responsibilities of the Central Coordinating Committee will include the following:

1. Review and evaluate proposals for compliance with the *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* and other criteria as dictated by the funding agency and/or Review Committee
2. Consider and require coordination of the proposal with other training and education projects conducted in the region or on a national basis
3. Prepare reports based on the review and evaluation (item 1 above) for referral to Review Committee
4. Collect and report additional data as requested by the Review Committee
5. Monitor contractees (funded institutions) for compliance with terms of grants; report findings and recommend actions to be taken by Review Committee or funding agency
6. Recommend and coordinate training needed by faculties of funded institutions, organize and implement such training where authorized and financed by funding agency
7. Assist Institutional Advisory Boards and coordinate their activities
8. Be cognizant of recruitment and placement issues regionally and locally in relation to national training needs and goals, develop pertinent data and report annually to the funding agency
9. Direct and coordinate the development, collection, and classification of instructional objectives (general and specific) and develop evaluation techniques for these objectives
10. Establish, implement, and direct a system of organization, storage,

retrieval, and dissemination for instructional objectives and/or information about related training resources

11. Develop the means to coordinate all grants, contracts, and training activities associated with the performance objective approach to training

12. Seek to develop and maintain cooperation and exchange of information among all funding agencies and organizations involved in training of wastewater personnel in order to avoid duplication of effort and to maximize the benefits incurred by the expenditure of funds for training

13. Assist the funding agency, other interested agencies, and professional organizations in the dissemination of information concerning projects, programs, institutional participation, and training packages.

B. Organization

1. The funding agency will initiate and direct the establishment of the Central Coordinating Committee.

2. The Central Coordinating Committee will have no fewer than three full-time staff members as follows:
   a. A full-time director
   b. A full-time assistant director
   c. A full-time secretary.

3. The funding agency, or its representative, will appoint the director for a period of not less than one year, with renewal of contract dependent on director's performance.

4. The combined qualifications of the director and the assistant director will include at least the following:
   a. At least three years' practical experience related directly to modern instructional technology (including the use of the behavioral objective/validation paradigm). At least one year's employment as a successful (employer-rated) manager is desirable but not mandatory

b. At least four years' applied experience directly related to wastewater treatment plant operation. One year or more experience in related training activities is desirable but not mandatory.

5. Subsequent professional staff including consultants employed will have experience comparable in kind (in quantity it may be more or less) to that of the director and assistant director.

6. The location of the Central Coordinating Committee facilities will be determined by the director with the approval of the funding agency.

7. The Central Coordinating Committee will be financed directly or indirectly by a grant from the funding agency, and with approval of the primary funding agency, the Central Coordinating Committee may also accept funding from other agencies and organizations for the performance of certain expressed services compatible with those of the Central Coordinating Committee generally.

C. Operation

1. Broad administrative direction will be provided the Central Coordinating Committee through the terms of the grant establishing the Committee. The Review Committee and the funding agency may continuously monitor the activities of and provide advice to the Central Coordinating Committee.

2. The day-to-day operation of the Central Coordinating Committee and the administration of its budget will be the sole responsibility of the Committee's director.

3. The director of the Central Coordinating Committee will have full responsibility with regard to regular staff and consultants.

4. The annual budget will be prepared by the director for each fiscal year, subject to the approval of the appropriate funding agency.

TRAINEE CHARACTERISTICS
TWO YEAR POST HIGH SCHOOL WASTEWATER TECHNOLOGY TRAINING PROGRAM

PURPOSE

This documentation provides general guidance to the training institution on the recruitment and placement of trainees. The information provided relates to the expected characteristics of the trainee when entering and when graduating from the training program.

TRAINEE CHARACTERISTICS WHEN ENTERING PROGRAM

It is beyond the scope of the present effort to offer objectively qualified characteristics (e.g., a characteristic as indicated by a certain score on a specified testing instrument). However, it is expected that the training institution will develop (in cooperation with the funding agency or its representative) and use such an objective approach in its trainee recruitment and selection procedure. Standards of acceptance for all categories will be determined by the institution in consultation with the Central Coordinating Committee. The present document will offer only general guidance as to the types of factors to be used in trainee selection. Selected trainees will be represented in two groups.

1. Principal Trainee Group

   The essential characteristic of this group is that the trainees be recent high school graduates or have attained equivalent academic accomplishment through remedial work and/or testing (e.g., GED). Trainees of this group must have no water or wastewater treatment work experience. Trainees of this group will comprise at least two-thirds of the recruits for a given training class.

   Trainees should be further screened and selected with respect to the following:

   a. Formal education. To the extent that it can be objectively determined, the trainee's academic accomplishment should be representative of at least the middle third of the national population.

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b. Aptitudes. A model profile of "ideal" trainee aptitudes should be determined. Using standardized tests and their normative data, a trainee's specific aptitude profile will be developed and compared to the model profile. Standards of acceptance should be determined and applied with respect to at least the following:

(1) General intelligence (achievement)

(2) Verbal skill

(3) Numerical skill

(4) Clerical skill

(5) Spatial perception

(6) Form perception

(7) Motor coordination

(8) Finger dexterity

(9) Manual dexterity

(10) Eye-hand-foot coordination

(11) Color discrimination

(12) Visual acuity

(13) Auditory acuity

(14) Olfactory acuity

c. Interest. A model profile of "ideal" tainee interest should be determined. Using pre-entrance orientation (including plant visitation), personal counseling, and standardized tests and their normative data, a trainee's specific interest profile will be developed and compared to the model profile. Standards of acceptance should be determined and applied with respect to at least the following interest categories:

(1) The environment

(2) The natural and physical sciences

(3) Mechanical technology

(4) Professional or paraprofessional employment

(5) Public service opportunity

(6) Wastewater treatment employment

d. Temperament. A model profile of "ideal" trainee temperament should be determined. Using pre-entrance orientation, personal counseling, and standardized tests and their normative data, a trainee's specific temperament profile will be developed and compared to the model profile. Standards of acceptance should be determined and applied with respect to the following conditions:

(1) Working at all levels of supervision

(2) Being appropriately responsive in the face of political, regulatory and public scrutiny and criticism

(3) Maintenance of quality performance in the face of highly repetitive, routine procedures

(4) Acceptance of the responsibility for the safety and welfare of one's self, one's fellow workers, and the public.

e. Physical capability. A model profile of "ideal" trainee physical capacity should be determined. Using medical examinations and standardized tests and their normative data, a trainee's specific physical capacity profile will be developed and compared to the model profile. Standards of acceptance should be determined and applied with respect to at least the following activities:

(1) Climbing
(2) Balancing
(3) Stooping
(4) Kneeling
(5) Crouching
(6) Reaching
(7) Handling
(8) Fingering
(9) Lifting

f. Physical sensitivity. A model profile of "ideal" trainee physical tolerance should be determined. Using medical examinations, personal counseling, and standardized tests and their normative data, a trainee's specific physical tolerance profile will be developed and compared to the model profile. Standards of acceptance should be determined and applied with respect to the following conditions:

(1) Year-round inside work
(2) Year-round outside work
(3) Temperature changes
(4) Risk of bodily injury
(5) Fumes
(6) Odors
(7) Dust
(8) Toxic conditions

In the course of trainee selection procedures involving "a" through "f" above, it will sometimes become obvious that the proposed trainee is capable of a much higher level of training and employment opportunity than that offered by the subject program. In such cases the trainee should be counseled and provided assistance, if he wishes it, in seeking opportunities in the water quality field that better fit his capabilities. Applicants whose capabilities fall within the ideal range of capabilities should be given priority for admittance into the program.

2. Alternative Trainee Group

Trainees of this group could comprise from one-fifth to one-third of the recruits for a given training class. Trainees of this group will be representative of the following:

a. Educationally deficient. If an applicant meets all conditions in "1" above *except* those relating directly or indirectly to formal education ("a" and some of "b"), he may be accepted into the program if he is willing to undertake remedial, basic education to be provided or arranged by the selected training institution. All remedial work should be satisfactorily completed *before* the trainee begins the regular program. Therefore, it will be necessary to recruit trainees in this category well in advance of the regular program in which they will participate.

b. Experienced wastewater treatment system employees. If an applicant meets all conditions as stated in "1" or "2a" above except the "must have no water or wastewater treatment work experience" requirement and has at least one year of acceptable (employer-rated) experience in a wastewater treatment system, he may be accepted into the program.

TRAINEE CHARACTERISTICS WHEN GRADUATING FROM THE PROGRAM

The information to follow is offered to provide the training institution a rather general indication of the desired capabilities of the trainee when he graduates from the subject training program. This information should be used to help the institution devise its trainee placement program.

1. Skill and Knowledge Possessed by Program Graduate

a. General skill and knowledge. The program graduate will be expected to have hands-on skill* and knowledge* with respect to certain *specific* functional procedures and process units* representative of those in wastewater treatment plants. He will be able to relate, at least verbally*, other process units similar in form and function to the *specific* units. The program graduate will be able, with confidence and relative ease, to adapt the *specific* skill and knowledge acquired expressly through the training program to the many plants and processes not covered directly in the training program. The *specific* skill and knowledge acquired will relate to procedures in the areas of "normal operations"*, "abnormal operations"*, "preventive maintenance"*, "corrective maintenance"*, "laboratory control"*, "systems interaction"*, and "management/supervisory"*.

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* Refer to the Glossary (page 35) for the indicated words.

b. Specific skill and knowledge. The *Curriculum Guidelines* as represented in *Volume II* indicates the *specific* skill and knowledge (behavior*) to be acquired by the trainee and is to be the basis for the training programs provided by the selected institutions. However, a reading of the "General Criterion Behaviors"* (refer to *Volume II*) is recommended at this time to provide a quick view of the *specific* skill and knowledge implied by the *Curriculum Guidelines*.

2. Positions for Which the Program Graduate is Prepared

a. General positions. Graduates should be regarded as technologists and paraprofessionals. This implies competence as a technician (involving hands-on level of application) with the ability to relate performance of the most basic procedure to the overall mission of the plant and to other procedures.

When performing those procedures of "normal operation", "abnormal operation", "preventive maintenance", "corrective maintenance", or "laboratory control", the program graduate will require varying degrees of supervision during his first weeks on the job or until such time as he is acquainted with the unique character of the plant and its operation. For example: to make a suspended solids determination on the mixed liquor, the trainee should need little or no supervision; however, to determine if the addition of lime to a stuck digester is necessary, he should be supervised more closely. In any case, the supervision required should be only occasional and brief. When performing the "management/supervisory" and "systems interaction" procedures, the trainee will require appreciably more supervision initially but should acquire the necessary competence and confidence much more quickly than is generally the case in on-the-job development. In fact, for all procedures the graduate should require no extensive in-depth on-the-job training after a brief initial orientation to his employment, and the amount of technical supervision needed should decline rapidly and remain minimal.

b. Specific positions. In most cases, the program graduate should enter employment as an "intern" preparing for rapid advancement to one of three positions; in some cases, the entry position may be that of sole employee. The actual position will depend on the plant size; for example:

Plant Size	Position
Less than 1 MGD**	Plant Manager
Up to 10 MGD	Plant Manager Internship
Up to 30 MGD	Asst. Plant Manager Internship
More than 30 MGD	Shift or Process Supervisor Internship

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* Refer to the Glossary (page 35) for the indicated words.

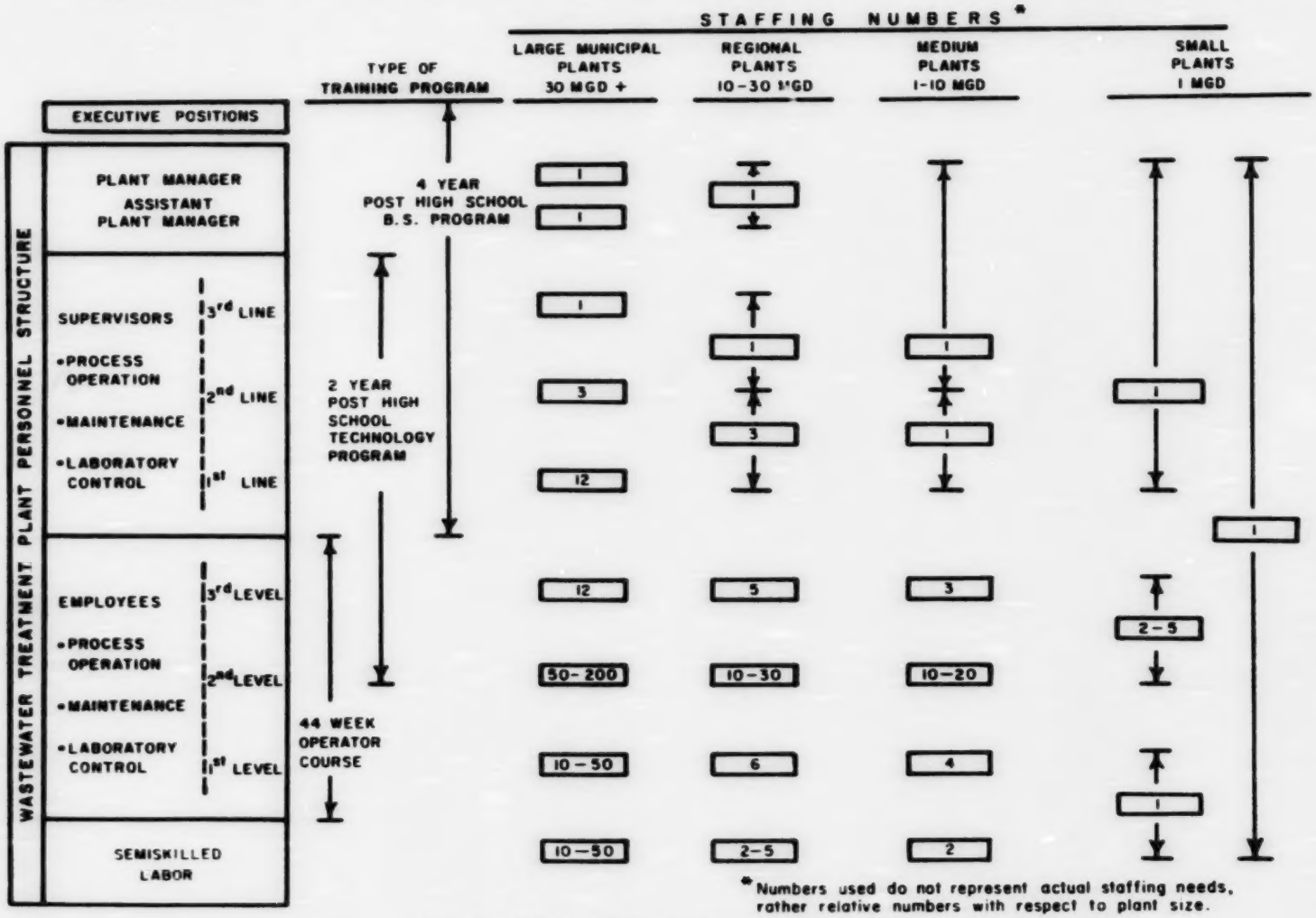
** Million gallons per day

There is nothing inherent in the proposed curriculum that will selectively prepare a trainee for any one of the above positions. Basic personality, personal ambition, geographic preferences, and job availability are factors that will continue to exercise significant influences in the choices and chances of the program graduate. It is enough to expect of the training that it prepare the graduate to perform satisfactorily in the position that is selected.

Although the program graduate may, at the outset of his employment, perform the most basic tasks and serve brief periods in a variety of jobs and at various levels of responsibility, his terms of employment (e.g., title) should clearly indicate his internship (e.g., shift foreman trainee or intern). Remuneration, advancement, and other employment advantages should reflect the special skill and knowledge acquired through the two year post high school wastewater technology training program.

The chart on the opposite page shows the relationship of the subject training program to other training programs at a higher and lower level of skill and knowledge in the wastewater treatment field. The placement of most of the program graduates is indicated and the expected overlaps graphically presented.

RELATIONSHIP OF PLANT SIZE TO TRAINING PROGRAM AND TO STAFF LEVEL AND NUMBER



*Numbers used do not represent actual staffing needs, rather relative numbers with respect to plant size.

Developed by Joe Bahnick, Division of Manpower and Training, WQO, EPA

APPENDIX

PUBLIC LAW 91-224, H.R. 4148

The preparation of the *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training Programs* was made possible and funded according to the provision of the Water Quality Improvement Act of 1970 (Public Law 91-224, 91st Congress, H.R. 4148). The applicable sections of this law follow:

"TRAINING GRANTS AND CONTRACTS

Colleges, water quality control.

"SEC. 16. The Secretary is authorized to make grants to or contracts with institutions of higher education, or combinations of such institutions, to assist them in planning, developing, strengthening, improving, or carrying out programs or projects for the preparation of undergraduate students to enter an occupation which involves the design, operation, and maintenance of treatment works, and other facilities whose purpose is water quality control. Such grants or contracts may include payment of all or part of the cost of programs or projects such as—

"(A) planning for the development or expansion of programs or projects for training persons in the operation and maintenance of treatment works;

"(B) training and retraining of faculty members;

"(C) conduct of short-term or regular session institutes for study by persons engaged in, or preparing to engage in, the preparation of students preparing to enter an occupation involving the operation and maintenance of treatment works;

"(D) carrying out innovative and experimental programs of cooperative education involving alternate periods of full-time or part-time academic study at the institution and periods of full-time or part-time employment involving the operation and maintenance of treatment works; and

"(E) research into, and development of, methods of training students or faculty, including the preparation of teaching materials and the planning of curriculum.

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"APPLICATION FOR TRAINING GRANT OR CONTRACT; ALLOCATION OF GRANTS OR CONTRACTS

"SEC. 17. (1) A grant or contract authorized by section 16 may be made only upon application to the Secretary at such time or times and containing such information as he may prescribe, except that no such application shall be approved unless it— Conditions.

"(A) sets forth programs, activities, research, or development for which a grant is authorized under section 16, and describes the relation to any program set forth by the applicant in an application, if any, submitted pursuant to section 18;

"(B) provides such fiscal control and fund accounting procedures as may be necessary to assure proper disbursement of and accounting for Federal funds paid to the applicant under this section; and

"(C) provides for making such reports, in such form and containing such information, as the Secretary may require to carry out his functions under this section, and for keeping such records and for affording such access thereto as the Secretary may find necessary to assure the correctness and verification of such reports. Reports to Secretary.

"(2) The Secretary shall allocate grants or contracts under section 16 in such manner as will most nearly provide an equitable distribution of the grants or contracts throughout the United States among institutions of higher education which show promise of being able to use funds effectively for the purposes of this section. Equitable distribution.

"(3)(A) Payment under this section may be used in accordance with regulations of the Secretary, and subject to the terms and conditions set forth in an application approved under subsection (a), to pay part of the compensation of students employed in connection with the operation and maintenance of treatment works, other than as an employee in connection with the operation and maintenance of treatment works or as an employee in any branch of the Government of the United States, as part of a program for which a grant has been approved pursuant to this section. Compensation of employed students.

"(B) Departments and agencies of the United States are encouraged, to the extent consistent with efficient administration, to enter into arrangements with institutions of higher education for the full-time, part-time, or temporary employment, whether in the competitive or excepted service, of students enrolled in programs set forth in applications approved under subsection (a).

"AWARD OF SCHOLARSHIPS

"SEC. 18. (1) The Secretary is authorized to award scholarships in accordance with the provisions of this section for undergraduate study by persons who plan to enter an occupation involving the operation and maintenance of treatment works. Such scholarships shall be awarded for such periods as the Secretary may determine but not to exceed four academic years.

"(2) The Secretary shall allocate scholarships under this section among institutions of higher education with programs approved under the provisions of this section for the use of individuals accepted into such programs, in such manner and according to such plan as will insofar as practicable—

"(A) provide an equitable distribution of such scholarships throughout the United States; and

"(B) attract recent graduates of secondary schools to enter an occupation involving the operation and maintenance of treatment works.

Program approval, conditions.

"(3) The Secretary shall approve a program of an institution of higher education for the purposes of this section only upon application by the institution and only upon his finding—

"(A) that such program has as a principal objective the education and training of persons in the operation and maintenance of treatment works;

"(B) that such program is in effect and of high quality, or can be readily put into effect and may reasonably be expected to be of high quality;

"(C) that the application describes the relation of such program to any program, activity, research, or development set forth by the applicant in an application, if any, submitted pursuant to section 16 of this Act; and

"(D) that the application contains satisfactory assurances that (i) the institution will recommend to the Secretary for the award of scholarships under this section, for study in such program, only persons who have demonstrated to the satisfaction of the institution a serious intent, upon completing the program, to enter an occupation involving the operation and maintenance of treatment works, and (ii) the institution will make reasonable continuing efforts to encourage recipients of scholarships under this section, enrolled in such program, to enter occupations involving the operation and maintenance of treatment works upon completing the program.

Payments to recipient of scholarship and his college.

"(4)(A) The Secretary shall pay to persons awarded scholarships under this section such stipends (including such allowances for subsistence and other expenses for such persons and their dependents) as he may determine to be consistent with prevailing practices under comparable federally supported programs.

"(B) The Secretary shall (in addition to the stipends paid to persons under subsection (a)) pay to the institution of higher education at which such person is pursuing his course of study such amount as he may determine to be consistent with prevailing practices under comparable federally supported programs.

"(5) A person awarded a scholarship under the provisions of this section shall continue to receive the payments provided in this section only during such periods as the Secretary finds that he is maintaining satisfactory proficiency and devoting full time to study or research in the field in which such scholarship was awarded in an institution of higher education, and is not engaging in gainful employment other than employment approved by the Secretary by or pursuant to regulation.

"(6) The Secretary shall by regulation provide that any person awarded a scholarship under this section shall agree in writing to enter and remain in an occupation involving the design, operation, or maintenance of treatment works for such period after completion of his course of studies as the Secretary determines appropriate.

"DEFINITIONS AND AUTHORIZATIONS

"SEC. 19. (1) As used in sections 16 through 19 of this Act—

"(A) The term 'State' includes the District of Columbia, Puerto Rico, the Canal Zone, Guam, the Virgin Islands, American Samoa, and the Trust Territory of the Pacific Islands.

"(B) The term 'institution of higher education' means an educational institution described in the first sentence of section 1201 of the Higher Education Act of 1965 (other than an institution of any agency of the United States) which is accredited by a nationally recognized accrediting agency or association approved by the Secretary for this purpose. For purposes of this subsection, the Secretary shall publish a list of nationally recognized accrediting agencies or associations which he determines to be reliable authority as to the quality of training offered. Accreditation. 79 Stat. 1266; 82 Stat. 1051. 20 USC 1141.

"(C) The term 'academic year' means an academic year or its equivalent, as determined by the Secretary.

"(2) The Secretary shall annually report his activities under sections 16 through 19 of this Act, including recommendations for needed revisions in the provisions thereof. Annual report.

"(3) There are authorized to be appropriated $12,000,000 for the fiscal year ending June 30, 1970, $25,000,000 for the fiscal year ending June 30, 1971, and $25,000,000 for the fiscal year ending June 30, 1972, to carry out sections 16 through 19 of this Act (and planning and related activities in the initial fiscal year for such purpose). Funds appropriated for the fiscal year ending June 30, 1970, under authority of this subsection shall be available for obligation pursuant to the provisions of sections 16 through 19 of this Act during that year and the succeeding fiscal year. Appropriations.

GLOSSARY

PLEASE NOTE: Words that appear in quotes within a definition are themselves defined within this Glossary.

ABNORMAL OPERATION PROCEDURES. Include those activities of the plant employee that result from abnormal (*unusual* and *undesirable*) conditions of the "wastestream". Abnormal procedures are designed to enable the plant employee to recognize when the wastestream is abnormal and to return it to an acceptable, normal condition. For example, the plant employee should recognize a black, septic influent to the primary settling tank as an abnormal condition of the wastestream, take whatever immediate action is appropriate, if any (e.g., eliminate source of black, septic wastewater to prevent further disruption of downline processes), then determine the cause, correct it and any other adverse effects of the abnormal condition. NOTE: Actual cause of septic condition could relate to failure to manually close supernatant valve (resulting from poor "Normal Operation Procedure"); or to malfunctioning of timer switch controlling supernatant valve (leading to a "Corrective Maintenance Procedure"); or to adverse industrial discharge in collection system (resulting from poor "Management/Supervisory Procedures"). ("GENERAL CRITERION BEHAVIORS" 201 and 202 relate to Abnormal Operation Procedures and can be seen in the Appendix of *Volume II*.)

*ALTERNATE (UNIT). Used within the description of the "Composite Model Plant" (CMP) to identify those "Other Units" that may be substituted for "Principal Units" when the latter are not available. In such a case, the Alternate Unit would be given "direct" representation in the curriculum.

BEHAVIOR. "Stimulus/response" interaction(s).

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*For maximum meaningfulness of this definition, first see those for "Unit", "Principal Unit", and "Other Unit".

BEHAVIORAL. Describing what a person's specific "response" should be to a given "stimulus" and the specification of how this basic stimulus/response component relates to other such components of a job (task, etc.).

BEHAVIORAL (TASK) ANALYSIS. The process of determining (and documenting) the "behavioral" components ("stimulus/response") of a job (task, etc.) by observing, analyzing, and/or creating actual or simulated performance of the person(s) involved.

BEHAVIORAL TRAINING OBJECTIVES. The "behavioral" specification of what the performance of a trainee should be after training. An integral part of objectives is the specification of the trainees relevant "pretraining repertory" and the specification of "posttraining performance evaluation conditions and criteria". (Who does what, when, and how well.)

COMPONENT (OF THE EQUIPMENT). Used to designate a distinctive *part* of a "process unit". Whereas the *reciprocating pump* on certain primary sedimentation process units is a component, the impeller on that pump is also referred to as a component.

COMPOSITE MODEL PLANT (CMP). A "verbal" representation of a "wastewater" treatment plant. This plant is a composite plant in the sense that it represents *many* different plants in one model. "Processes" are duplicated and duplicate means for accomplishing each process are indicated. This overall redundancy in the design of the model is directed toward assuring that trainee competence in the "skill" and "knowledge" mastery of *this* composite plant will ensure optimum transfer (generalization) of competency to almost any plant currently in operation. The CMP provides a *concrete* point of reference in deciding what specific skill and knowledge a trainee should acquire in order to have the level of mastery desired. The model is defined in *Volume II: Curriculum Guidelines* by a "Processes Chart" and a number of sheets titled "Specific Process Units". A letter of the alphabet identifies each *process* represented in the Composite Model Plant; each process is further defined by the *specific* "units" of equipment that are used to accomplish, or are related to the accomplishment of, the indicated process.

CORRECTIVE MAINTENANCE PROCEDURES. Include those maintenance activities of the plant employee that usually result from the breakdown and/or malfunction of a "unit" of equipment or a "component" thereof; for example, recognizing the indications of a malfunctioning timer switch on the supernatant valve serving the return line to the primary settling tank and knowing when and how to correct the disorder, or when and how to refer the problem to plant or contract maintenance personnel. ("GENERAL CRITERION BEHAVIORS" 401 - 403 relate to Corrective Maintenance Procedures and can be seen in the Appendix of *Volume II*.)

COVERT BEHAVIOR. "Behavior" in which the "response" (and usually the "stimulus") is *not* directly perceivable: e.g., thinking.

CRITERION. A standard by which to judge; a goal to achieve.

DIRECT (REPRESENTATION IN CURRICULUM). Indicating that the curriculum must be designed and implemented so as to ensure the same kind of practical, hands-on experience--"skill" and "knowledge"--a man would receive working in an actual plant. (Quality instruction in plant is assumed.)

GENERAL CRITERION BEHAVIOR. A comprehensive statement that defines "behaviorally" and "operationally" the general "skill" and "knowledge" desired of a trainee *after* training.

GENERAL CRITERION BEHAVIOR CATEGORIES. The seven groupings within which the thirty-seven individual "General Criterion Behaviors" are organized. The categories are *not* necessarily intended to represent the apparent grouping of behaviors in the actual operation of a plant; rather, the categories represent groupings of similar, related behaviors for ease in analysis and for brevity in documentation. The names of the categories are: "Normal Operation Procedures", "Abnormal Operation Procedures", "Preventive Maintenance Procedures", "Corrective Maintenance Procedures", "Laboratory Control Procedures", "Systems Interaction Procedures", and "Management/ Supervisory Procedures".

INDIRECT (REPRESENTATION IN CURRICULUM). Indicating that the curriculum must be designed and implemented so as to ensure an ability in the trainee to "verbally" relate certain aspects of "Other Units" to "Principal Units"--i.e., be able to say how they are similar and/or different functionally and/or mechanically.

INDIVIDUALIZED INSTRUCTION. Instruction that is represented by at least one, preferably both, of the following characteristics: (1) selective assignment of instruction to the trainee according to individual need is facilitated by pre- and posttesting, and (2) the trainee is permitted to learn at his own pace. Where necessary, instruction may be presented to a group (which would minimize self-paced learning), but the first characteristic must not be violated. All instruction should maximize the active involvement of the trainee by having him frequently answer questions, solve problems, and react to the information he is currently learning. The trainee must be provided prompt feedback regarding the correctness of his responses. Instruction should be modularized to facilitate individualizing a trainee's learning experiences, and all increments of instruction should be sized and sequenced to ensure the trainee's smooth and confident transition from the known to the unknown. Individualized instruction includes, but is not restricted to, instruction often referred to as "programmed".

IN-PLANT INSTRUCTION. Used to indicate a continuation of formal training as a trainee moves from the classroom/lab context into an actual, functioning facility. A high degree of structure is implied: detailed lesson plans will be employed, with specific performance objectives, and practical trainee testing procedures. Certified instructor/operators will be assigned to coordinate and supervise in-plant instruction as a primary part of their duties. Instruction (learning) is of primary concern in an in-plant instruction program--productive employment is a secondary factor.

KNOWLEDGE. That which is conveyed by an individual when "verbally" describing a job (task, etc.) or some related aspect of it. Related "skill" is not necessarily implied by "knowledge".

LABORATORY CONTROL PROCEDURES. Include those special and routine activities of the plant employee relating to laboratory analyses, the specification of sampling procedures and locations, and the general management of the laboratory facilities; for example, determining DO, determining the sample and analysis required for a given condition of the "wastestream". ("GENERAL CRITERION BEHAVIORS" 501 - 503 relate to Laboratory Control Procedures and can be seen in the Appendix of *Volume II.*)

MANAGEMENT/SUPERVISORY PROCEDURES. Include activities of the plant employee relating to employment practices, record keeping, plant operation policy, and the establishment of a constructive and realistic rapport between the plant and the community it serves. ("GENERAL CRITERION BEHAVIORS" 701 - 717 relate to Management/Supervisory Procedures and can be seen in the Appendix of *Volume II.*)

*NONALTERNATE (UNIT). Used within the description of the "Composite Model Plant" (CMP) to identify those "Other "Units that can *not* be substituted for "Principal Units".

NORMAL OPERATION PROCEDURES. Include those *routine* operating activities of the plant employee that do not vary significantly from day-to-day, and that are designed to *keep* the plant functioning within a normal range of values; for example, *routine* sampling at standard locations, *routine* inspections of equipment and "wastestream" to verify that the process is functioning properly, *routine* opening and closing of supernatant valve in return line to primary settling tank. ("GENERAL CRITERION BEHAVIORS" 101 and 102 relate to Normal Operation Procedures and can be seen in the Appendix of *Volume II.*)

OPERATIONAL. Describing the extent to which "behavior" ("skill" or "knowledge") is relevant (essential) to the performance of a job (task, etc.). In order for "skill" or "knowledge" to be considered operational,

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*For maximum meaningfulness of this definition, first see those for "Unit", "Principal Unit", "Other Unit", and "Alternate Unit".

an acceptably trained person must be able to demonstrate ("overtly" and/or "covertly") its direct application in accomplishing his job within *reasonable* limits imposed by *upper* and *lower* standards of performance. NOTE: It is *unreasonable* to train for rarely occurring circumstances or for obtuse or hypothetical conditions.

*OTHER (UNIT). Used within the description of the "Composite Model Plant" (CMP) to identify those "process units" that will be "indirectly" represented in the curriculum. Essentially, this means ensuring that the trainee can "verbally" relate Other Units to "Principal Units"--i.e., can say how they are similar and/or different functionally and/or mechanically. (See "GENERAL CRITERION BEHAVIOR" 607, shown in the Appendix of *Volume II*.)

OVERT BEHAVIOR. "Behavior" in which the "response" (and usually the "stimulus") is directly perceivable (can see it, hear it, etc.): e.g., talking, manipulating switches, writing, etc.

POSTTRAINING PERFORMANCE (BEHAVIOR). The trainee's application of relevant "behavior" after training (total or any portion thereof); this may include his "verbally" responding to verbal stimuli (e.g., questions, commands) as well as that "skill" including the hands-on behavior.

POSTTRAINING PERFORMANCE EVALUATION CONDITIONS AND CRITERIA. A description of the conditions under which "posttraining performance" is to be evaluated and the "criteria" are to be applied. Minimally, the description must make explicit the types of questions to be used, the testing environments to be used, the testing devices to be used, and the degrees (quantitative and qualitative) of completeness desired.

PRETRAINING REPERTORY. Used to designate the catagory of relevant experience ("knowledge" and "skill") that a trainee has before training. This prior experience should be excluded from explicit treatment in training;

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*For maximum meaningfulness of this definition, first see those for "Unit" and "Principal Unit".

if so, it must be stipulated as prerequisite knowledge and skill as appropriate.

PREVENTIVE MAINTENANCE PROCEDURES. Include those *routine* maintenance activities of the plant employee designed to *forestall* or *prevent* major equipment breakdown and subsequent corrective maintenance; for example, lubrication of bearings and other moving parts, replacing air and oil filters, *routine* replacement and/or adjustment of certain worn components. ("GENERAL CRITERION BEHAVIORS" 301 and 302 relate to Preventive Maintenance Procedures and can be seen in the Appendix of *Volume II.*)

*PRINCIPAL (UNIT). Used within the description of the "Composite Model Plant" (CMP) to identify those "process units" that will be "directly" represented in the curriculum. That is, with respect to the Principal Unit, the curriculum must be designed and implemented so as to ensure the same kind of practical, hands-on experience--"skill" and "knowledge"--a man would receive working with the actual process units, in an actual plant. (Quality instruction in plant is assumed.) Also, a Principal Unit is that specific process unit, which when mastered by the trainee, will *best* enable the trainee to operate *most* other units, *not* directly represented in the curriculum, but used to accomplish the subject process.

PROCESS. A physical, chemical, and/or biological interaction through which the "wastestream" is modified (treated).

PROCESS VARIATION. Variations in any "process" wherein the same "unit" (or "components" thereof) is used, but the way in which it is used is varied, or the way in which it processes the "wastestream" is varied. For instance, the same basic unit is used for aeration for a number of process variations of the aeration process, e.g., extended aeration, tapered aeration, conventional aeration, etc.

PROCESS UNIT. See "Process" and "Unit".

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*For maximum meaningfulness of this definition, first see the definition for "Unit".

PROCESSES CHART. A simple listing of the "processes" represented in the "Composite Model Plant", showing the letter of the alphabet used to identify each process.

RECALL. Refers to the ability of a person to "construct" or "compose", in part or in whole as required, primarily from memory, the appropriate "response" or "stimulus".

RECOGNIZE. Refers to the ability of a person to pick from among possible explicit alternatives the appropriate "response" or "stimulus".

REFERENCE TOOL. A device (documentation, etc.) that is used concurrently with, or as a part of, the performance of some job (procedure, task, etc.). The purpose of the reference tool is to provide information and/or instruction that the person involved is not normally expected to "know" from "recall". Reference tools, depending on their design purpose, may be brief and general in content or highly specific and detailed. Reference tools include parts catalogs and equipment specifications (including line drawings) that indicate *how the equipment works* and performance guides that indicate *how to work the equipment*. Reference tools may be in many forms: on separate pieces of cardstock, on pages in a book, on film for projection, on audiotape, on an engraved plate attached to a piece of equipment.

RESPONSE. The "overt" (manipulate, talk, etc.) or "covert" (think, realize, etc.) reaction of a person when confronted by an appropriate "stimulus".

RESPONSE DETAIL. An element of the "Specific Behavior Sheets". The Response Detail provides a maximum of additional information with a minimum of documentation. It may provide some actual content of instruction and "posttraining performance"; of greater importance, however, the Response Detail will provide, by implication, a more specific indication of the level and content of training.

SKILL. That which is conveyed by an individual when actually *doing* a job (task, etc.) properly. Usually implies a certain degree of "knowledge" also.

NOTE: Although "verbal behavior" is usually the mode for expressing "knowledge", verbal behavior is often a necessary part of skill; e.g., the ability to issue a proper oral command, or the ability to communicate on radio, or the ability to fill out (write) a sales slip.

SPECIFIC BEHAVIOR SHEETS. The basic data sheet for the *Curriculum Guidelines*. A sheet will contain the full statement of one of the thirty-seven "General Criterion Behaviors"; in most cases, it will contain a very specific material object of the subject "behavior" (e.g., the description of a specific "process unit"); and it will contain more explicit information ("Stimulus Detail" and "Response Detail") about what is implied by the general statement of the subject behavior.

SPECIFIC PROCESS UNITS SHEETS. The basic data sheet for the "Composite Model Plant" (CMP); a sheet will contain a listing of the several different "units" of equipment that may be used to accomplish one of the standard "processes" represented in the CMP. The "process units" listed on a sheet are grouped into "Principal" and "Other" ("Alternate" and "Nonalternate").

STIMULUS. An "overt" or "covert" condition, circumstance, indication, substance, reaction, awareness, etc. that becomes the unique *occasion* for a person's "response".

STIMULUS DETAIL. An element of the "Specific Behavior Sheets". The Stimulus Detail provides a maximum of additional information with a minimum of documentation. It may provide some actual content of instruction and "posttraining performance"; of greater importance, however, the Stimulus Detail will provide, by implication, a more specific indication of the level and content of training.

SYSTEMS INTERACTION PROCEDURES. Include those activities of the plant employee concerned with relating the functioning of specific "units" of equipment to other "process units" and to the system as a whole, relating specific processes to other processes and to the system as a whole, and relating the plant to the community which it serves; for example, determining

how the effective functioning of the grit removal process relates to other processes and the equipment involved, determining the desired characteristics of a plant for a given community. ("GENERAL CRITERION BEHAVIORS" 601 - 606 relate to Systems Interaction Procedures and can be seen in the Appendix of *Volume II*.)

TRAINING SYSTEM. One of several sub-systems which constitute the total management system. A training system is one with specific *functional unity* whose product is trained personnel and whose systematic process is directed and controlled by standardized concepts and techniques. Essential to the maintenance of an effective Training System is the development and use of "Behavioral Training Objectives" at a level of detail and "operational" relevancy that permits their use in course development, in course evaluation, in trainee selection and classification, and in evaluation of trainee's "posttraining performance".

UNIT. A specific piece of equipment, or a combination of equipment, that serves to accomplish one of the standard "wastewater" treatment plant "processes" represented in the "Composite Model Plant" (CMP). Rather than being identified by a *full* description of all salient characteristics, the *total* unit is defined by one or more very distinct and selective mechanical or functional characteristics; for example . . .

> "rectangular unit with telescopic valve draw off, density meter timeclock, and trough with scraper"

characterizes a *total* process unit used to accomplish the primary sedimentation process as represented in the CMP.

VERBAL. That which is either oral (spoken) or written.

VERBAL BEHAVIOR. Consisting of either or both of oral or written "stimuli" and/or "responses".

WASTESTREAM. The influent or effluent from any "process unit" of a "wastewater" treatment plant. This includes liquids as well as solids; for example: raw wastewater, treated effluent, screenings, grit, recycled flow from

secondary clarifier, digester sludge, vacuum filter sludge, or drying bed sludge. (Compare with "wastewater": Within the collection system, the two terms are synonymous; once within the treatment plant proper, only the term wastestream is appropriate.)

WASTEWATER. The used water of a community, including the domestic, commercial, and industrial liquid wastes and the ground, surface, and storm water. (Compare with "wastestream": Within the collection system, the two terms are synonymous; once within the treatment plant proper, only the term wastestream is appropriate.)